

**ADAPTION AND VALIDATION OF THE GERMAN VERSION OF THE  
BASIC PSYCHOLOGICAL NEEDS IN PHYSICAL EDUCATION  
SCALE**

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## ABSTRACT

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It is important to understand students' motivation regarding physical activity to investigate the global issue physical inactivity. Based on the *self-determination theory* (SDT: Ryan & Deci, 2002), which is one of the most important frameworks in explaining motivation, students need to be emotionally satisfied in order to put effort towards a certain goal. The Basic Psychological Needs Theory is one sub-theory of the self-determination theory, which explains that constructs of autonomy, competence, and relatedness need to be satisfied in all humans in order to increase well-being. It is important to understand students' motivation regarding physical activity to investigate the global issue of physical inactivity. In order to adapt a scale to another language, a reliable and valid scale is necessary. This procedure allows further research on motivational issues in other countries as well as comparison studies.

Therefore, the main aim of this study was to adapt the Greek Basic *Psychological Needs in Physical Education Scale* (BPN-PE: Vlachopoulos, Katartzi, & Kontou, 2011) to German. After translating the scale, the BPN-PE scale's factorability, internal consistency and test-retest reliability were examined. Finally, factorial and construct validity of the BPN-PE scale were explained. The three-factor structure of autonomy, competence, and relatedness of the original scale was hypothesized to be the same in the adapted German version.

After obtaining permission to conduct the research from local school principals, a pilot test with 5<sup>th</sup> grade students ( $n = 20$ ), age 11-12, was conducted at one high school in Germany. Secondary educational institutions (Germany) were used to collect data from 7<sup>th</sup> to 10<sup>th</sup> grade students ( $n = 372$ ). Finally, a third wave of data for the needs of the test-retest procedure was collected from 90 students.

In order to examine the construct validity of the BPN-PE, two other scales (Perceived Autonomy Support Scale and Subjective Vitality Scale) were used as criterion validity instruments.

All the BPN-PE factor scores showed moderate correlation with the Perceived Autonomy Support Scale and the Subjective Vitality Scale ranging between .33 and .61 which indicates satisfactory criterion validity. Cronbach's alphas ranged from .705 to .875. The Principal Component Analysis revealed that three specific sets of items (autonomy, competence and relatedness) explained 68 % of the variance in the BPN-PE scale. Consequently, the translated BPN-PE scale is considered reliable and valid for German PE student population. Limitations of the study and further suggestions are discussed.

Keywords: Self-Determination Theory, Basic Psychological Needs in Physical Education Scale, adolescents, German, translation, validation

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# 1 INTRODUCTION

## 1.1. Benefits of Physical Activity

It is commonly accepted that physical activity has a lot of benefits at all ages (McKenzie, Marshall, Sallis, & Conway, 2000). More specifically, physical activity reduces obesity, increases self-efficacy and prevents chronic diseases (Azevedo, Araujo, da Silva, & Hallal, 2007; Trudeau, Laurencelle, & Shephard, 2009; World Health Organization, 2010).

Particularly during adolescence physical activity can build a foundation for preventing a sedentary lifestyle in later life. Azevedo et al. (2007) also suggested that a special focus should be given to children and young adults in order to discourage inactivity in developmental stages. Among adolescents physical activity can increase attention and concentration in school, teach social skills, and provide generally a healthy lifestyle (Ericsson & Karlsson, 2011; Haarwood, Miller, & Vasta, 2008). Researchers (Trudeau & Sheppard, 2008) examined that physical activity is correlated to intellectual performance in school settings. More specifically, it has benefits regarding concentration, memory and classroom behavior. Moreover, it is determined that increased levels of physical activity can enhance students' self-esteem (Coe, Pivarnik, Womack, Reeves, & Malina, 2006).

Physical inactivity on the other hand, can lead to obesity and unhealthy behavior. Physical inactivity is highly correlated to overweight. More specifically, 11 percent have prevalence for overweight in Germany and only 26 percent are reported to be physically active (Janssen, Katzmarzyk, Boyce, Vereecken, Roberts, Currie, Pickett, & HBSC, 2004).

Unfortunately, as presented in global cross-cultural studies (Dumith, Hallal, Reis, & Kohl III, 2011), research shows that physical inactivity becomes a bigger issue worldwide. In a research conducted in the United States in 2002 15 percent of adolescent Americans were overweight, as compared to 5 percent in 1970. Physical inactivity is seen as one predictor that imbalances energy intake and expenditure. Although a significant decline in physical activity among youths is apparent, little or no interventions are done (Physical Inactivity among Young People, 2002).

## 1.2 Physical Inactivity among Adolescents

Apparently, for two thirds of Europeans above the age of 15 the benefits of physical activity do not provide sufficient motivation to be more active as this proportion was determined to be obese in 2002 (World Health Organization, Europe, 2006). According to the World Health Organization (2010) physical inactivity globally is the fourth most leading mortality risk factor and in Germany over 20 percent of the population is prevalent to physical inactivity. Societal concerns are already addressed in articles that recommend specific amounts of activity a day or week (American Academy of Pediatrics, 2006). For example, the World Health Organization (2010) suggests 60 minutes of vigorous activity a day for 12 to 16 year olds. In order to reduce physical inactivity, environmental changes, as well as educational and organizational facilitations are recommended (Pate, Yancey & Kraus, 2009). Environmental risk factors that should be addressed are high-calorie food intake, a family background of obesity, and a lack of education (American Academy of Pediatrics, 2006). In contrast, adolescent's physical activity with family, friends or other groups should be further encouraged. An adolescent's environment should be supportive of what he or she likes to do, not what the legal guardian's own will and wishes are. It is important that adolescents have an opportunity to be active with their friends and develop a passion for doing sports (American Academy of Pediatrics, 2006). To overcome barriers it is particularly important to look at adolescent's motivation and increase the fun factor of physical activity.

## 1.3 How to motivate children to be physically active?

Many youths are raised in non-activity supportive environment and are hindered to become acquainted with sports and physical activity. In this case physical education can be very helpful, because it reaches all adolescents in school settings. Consequently, the research aim is to use this dissemination to familiarize the students with the positive effects of physical activity. The goal is to find an intervention to promote physical activity and increase satisfaction of students. According to Weiss (2011) the key to promoting enjoyment in physical activity is to increase students' respective psychosocial and behavioral competencies. In other words, by integrating autonomous intentions in physical

activity interventions an increase of student's self-esteem is one positive side effect (Hein & Hagger, 2007). Consequently, it is important to assess specific needs of students and their motivational structure. One way to describe this structure is provided by the *Self-Determination Theory (SDT)* (Deci & Ryan, 2008; Ryan & Deci, 2000, 2009) and its sub-dimensions. SDT is currently one of the most important and most used frameworks to describe and explore motivation (Ryan & Deci, 2000). According to SDT, individuals' motivation is affected by the social environment (e.g. the physical education classroom) and how well this satisfies their basic psychological needs.

#### 1.4 Self-Determination Theory in the Context of Physical Activity Classes

Consequently, it is very valuable to understand the motivation of students. According to Deci and Ryan (2008) this is especially important in the field of physical education, where it is not always easy to make the student feel integrated and emotionally attached. Also their level of autonomy can be expanded for example by “acknowledging students' feelings and perspective about the activity...us[ing] language that conveys choice” (Ntoumanis & Standage, 2009, p. 200). The self-determination theory refers to conceptual levels of motivation, which includes intrinsic-, extrinsic-, and amotivation (Motl, 2007). John Wang, Liu, Sun, Coral Lim, and Chatzisarantis (2010) suggested, based on SDT, that task orientation needs to be improved in order to motivate students. Providing leadership and autonomy in students helps to make students intrinsically motivated, which could further force the mandatory nature of PE in the students' background. According to Vallerand (2000) throughout the varying degrees of motivational aspects intrinsic motivation is favored because basic psychological needs are satisfied. Students who are intrinsically motivated are driven by their own needs or enjoyment of the task instead of being externally pressured or rewarded.

#### 1.5 Autonomy, Competence, and Psychological Relatedness of Students

SDT is further differentiated in autonomy, competence, and psychological relatedness for need satisfaction as mentioned in the *Basic Psychological Needs Theory (BPNT)*: Deci & Ryan, 2008). If the basic psychological needs are not satisfied motivation decreases. Consequently, basic psychological needs ought to be satisfied in the classroom context

(Niemeck & Ryan, 2009). The cross-cultural study of Levesque, Zuehlke, Stanek, & Ryan (2004) resulted in specific suggestions that basic psychological needs in schools anywhere should be satisfied in order to experience well-being in students.

Autonomy can be explained as the individual making decisions and being responsible for one's action. In PE this feeling of worthiness can lead to higher class participation. As one motivational part, autonomy within a coach-athlete relationship was evaluated by Adie, Duda, & Ntoumanis (2008) suggesting that there is an interrelation between basic need satisfaction and subjective well-being. The coach that emphasizes decision making of athletes also listens to their wishes and opinions. Furthermore, autonomy is likely to be linked to satisfaction and strong connection between teammates, as well as associated with the coach's consideration of athlete's perception and choices (Adie et. al 2008). This coach-athlete relationship based on SDT leads to more intrinsic motivation, and consequently increases willingness to be physically active in future (Almagro, Saenz-Lopez, & Moreno, 2010). This concept also applies to the PE context; students who were educated by an autonomy supportive authority reported more PA in leisure time activity than students who were less autonomy supported. Consequently, SDT is a useful framework that supports leisure time activity in students (Chatzisarantis & Hagger, 2009; Hagger, Chatzisarantis, Hein, Soos, Karsai, Lintunen, & Leemans, 2009; Lim & Wang, 2009).

Competence means that the individual feels capable to solve a task successfully with one's own abilities. In PE the exercises need to be adapted to the students' capabilities to increase motivation. Perceived competence in students increases self-determination, which further enhances a task-involving climate. This means that if the teacher emphasizes progress and effort over competition, the student is more likely to be motivated and satisfied (Kalaja, Jaakkola, Watt, Liukkonen & Ommundsen 2009). Teachers should become aware of their interaction with students. It is recommended that feedback should be positive and informative to increase achievements and competence in students.

Relatedness can be explained as feeling connected to and integrated with others. Relatedness leads to general pro-social behavior within in-class and out-of-school settings,



which can further lead to positive social outcomes and task-involvement (Pavey, Yancey, & Sparks 2011). A task-involving motivational climate provided by the physical education teachers is interrelated with the perceived performance of physical education students. Students feel an increase of their general self-perceived motivations for PA and enhance their performance and skills (Kalaja et al., 2009). Also, teachers themselves are in need of relatedness towards colleagues and their students. Satisfaction of the need for relatedness leads to higher motivation in teachers, which moreover results in more engagement of students providing a positive work climate (Klassen, Frenzel, & Perry, 2012).

Furthermore, the satisfaction of the basic psychological needs results in autonomous motivation of students (Barcoukis, Hagger, Lambropoulos, & Tsorbatzoudis, 2010). Brickell, Chatzisarantis, and Pretty (2006) used the theory of planned behavior to predict exercise behavior and consequently a healthy lifestyle. The attitudes in planned behavior are adapted from SDT and derive from subjective norm and also relative autonomy. If autonomy is provided people are more likely to exercise intentionally. Intentional behavior arises through the internal motivation of humans when autonomy, relatedness and autonomy are provided. Consequently, intention formation through perceived control and positive attitude can help to motivate students (Brickell et al., 2006).

Moreover, it was studied how a motivational climate can be provided using the theories above. It is important to first evaluate the actual motivational climate, before it can be intervened. Bryan and Solmon (2007) provided the development of a theoretical framework from motivational constructs like SDT to promote PE. It can be used to involve more students in physical activity. Furthermore, the appearance and interaction of teachers towards students might be just as important as what content they teach in a PE setting (Koka, & Hagger, 2010). Teachers should evaluate themselves how they can introduce psychological needs of students into the daily PE setting to increase self-motivation of students through group thinking and feelings of worthiness (Bryan & Solmon 2007). Furthermore, it is recommended to support autonomy, to reduce pressure and stress, and to provide regular constructive feedback for the students (Levesque et al. 2004). In this context it is important to consider possible differences concerning the students' needs and interests in connection to the social and cultural backgrounds. The research showed that the

focus on competency is preferable over competition in PE classes, which is also related to the teacher's empathy and connection to the students that all in all leads to self-regulation and – management (Bryan & Solmon 2007). Greater internalized regulation of exercise behavior then leads to greater satisfaction of basic needs in exercise (Wilson & Rodgers, 2008). Finally, when basic psychological needs are met, PE students give more priority to PE and they are self- and intrinsically motivated (Moreno Murcia, González-Cutre Coll, & Ruiz Pérez, 2009; Pihu, Hein, Koka, & Hagger, 2008). Moreover, basic psychological need satisfaction leads overall to persistency of students and teachers with a side-effect of satisfaction (Standage, Duda, & Ntoumanis, 2006). The positive motivational climate increases self-worthiness in students, which consequently decreases performance excuses (Standage, Treasure, Hooper, & Kucka, 2007). All in all, if basic psychological needs are satisfied, likelihood of intrinsic motivation and long-term physical activity involvement is increased.

#### 1.6 The Basic Psychological Needs in Physical Education Scale

Because the satisfaction of the basic psychological needs is so relevant in determining students' motivation in PE, the motivational climate has to be determined beforehand. The *Basic Psychological Needs in Physical Education Scale (BPN-PE)*: Vlachopoulos, Katartzi, & Kontou, 2011) is a 12-item instrument that examines the three basic psychological needs in physical education context. The original scale was developed in Greek language and was validated for adolescents. Because it is only available in Greek language, it is important to validate this scale in more countries.

For the purpose of the study the scale needed to be translated from Greek to German. The BPN-PE is used to evaluate cross-cultural validity for the specific German culture. In context of the BPN-PE scale it is important to examine the cross-cultural validity across borders. In a study from Taylor & Lonsdale (2010) it was determined that psychological need satisfaction is interrelated with autonomy support and well-being.

Adapted from Vallerand (1989) there are 7 steps used to validate and translate instruments: preparation of preliminary versions, valuation of preliminary versions and preparation of an experimental version, pretest of an experimental version, evaluation of the content and

concurrent validity, reliability analysis and evaluation of validity, and finally construct of effect (Banville et al. 2000). This translation and validation technique was already used in several published articles (Sousa, & Rojjanasrirat 2011). It is important to validate the scale and not just translate it, although the Greek version was already validated. Moreover, the scale needs to be evaluated in the cultural context by using a pilot test, because the questions will be seen from another perspective. Giffee (2001) and Papaioannou, Kosmidou, Tsigilis, and Milosis (2007) furthermore described the process of validation and establishing instrument reliability, as well as the importance of selecting an appropriate instrument and components of a motivational climate in physical education setting.

### 1.7 The Educational System in Germany

For the target group the focus chosen on the basic structure of the educational system between the ages of 4 to approximately 20. Furthermore, not all exceptions of certain states in Germany are mentioned, but it is narrowed down to the most general way of a student's pathway, which was also present in the sample population. From age 3 to 6 students children join pre-school education (Kindergarten) on a voluntary basis. Afterwards, the primary education by law starts in form of a general school (Grundschule) up to the age of approximately 10 (Grade 4). The secondary school continues with grade 5 differentiated in lower education (Hauptschule), medium education (Realschule) and advanced education (Gymnasium). At Hauptschule and Realschule the educational attendance by law stops after 9<sup>th</sup> grade, but students can continue for a higher degree until 10<sup>th</sup> grade (age ca. 16). At Gymnasium the students continue voluntarily until 12<sup>th</sup> grade to obtain the right to study further at universities. Overall, from grade 1 through 9 students with special needs can attend special schools that fit their need of disability. Moreover, from 4<sup>th</sup> to 12<sup>th</sup> grade comprehensive (Gesamtschule) and private schools exist, where all different degrees can be obtained. The distribution of the school population in grade 8 (2010) was as follows: Hauptschule 16.6 percent, Realschule 25 percent, Gymnasium 36.3 percent, Gesamtschule / integrative schools 17 percent, and special schools 4.2 percent (Basic Structure of the Education System in the Federal Republic of Germany – Diagram, 2010).

### 1.8 Gap in Literature – Situation in Germany

Ntoumanis (2002) examined in his research the benefits that SDT has in PE, but furthermore he suggested developing the research by being able to evaluate the specific psychological needs of PE students; this research attempts to do just that. Moreover, the SDT is not yet fully integrated in the PE context, with a special emphasis on its effects on physical activity. In order to evaluate the positive outcomes of SDT in PE it is important to validate a scale that can be easily used (Ntoumanis, 2002). In most research in Germany it is provided that the increase of technology leads to more distraction in regards of a physical active environment. This affects the physical and psychological development of children. Consequently, Children in Germany become overweight and some of the initiative consequences are difficult to compensate during adulthood (Boesenberg, 2008). In Germany there is not enough literature provided in context of a motivational climate in a physical education setting. Some professional recommendations describe the integrative school system and an increase of school sport as beneficial, but it is not described how a positive climate can be provided through an autonomy supportive teaching style (Laging & Hildebrandt-Stramann, 2006). Furthermore, importance of physical activity during adolescence is provided. Besides positive bio-psychosocial effects, Governments of Germany and Switzerland suggest that sport helps to prevent addiction and increases school performance (Bundesamt für Sport, Bundesamt für Gesundheit, Schweizerische Gesellschaft für Prävention und Gesundheitswesen, Schweizerische Gesellschaft für Pädetrie, Schweizerische Gesellschaft für Sportmedizin, & Netzwerk für Gesundheit und Bewegung Schweiz). As a result, there is a need for a scale that provides empirical information about the physical education in Germany.

## 2 PURPOSE OF THE STUDY

The main aim of this study was to adopt the Greek Psychological Needs in Physical Education Scale to German. During this study reliability and internal structure were examined. It was suggested that the German scale would keep the same three-factor structure as the original Greek scale. Although the scale is validated in Greek, there is a need of validating the scale in the specific German culture. The three subscales of competence, autonomy, and relatedness have four items each based on the Basic Psychological Needs Theory (Ryan & Deci, 2000).

Primarily, a validated scale of this kind is important to assess the motivation of PE students and to further develop PE in schools. Moreover, this scale can be used for other subjects as the results of data collection can lead to further awareness of the student-teacher climate and interaction in general. The scale can be extensively used as index of effectiveness on the motivation of students in any intervention program. Furthermore, after validating the scale, gender and cross-cultural differences can be also investigated.

### 3 METHODOLOGY

#### 3.1 Participants

Participants are from a rural area in the northwest of Germany. All schools are located within an area of 5 km and classes were randomly selected of whatever class teacher offered to take time for the research. However, the amount of students involved from each school represents the distinction in population. Since the German school system is divided into different levels of expertise, the data was collected from the three most common school forms of Hauptschule (low educational level), Realschule (medium educational level), and Gymnasium (high educational level). A number of partly or incorrectly filled out questionnaires were omitted, mainly due to language barriers.

The dataset represents 372 students consisting of 194 male and 178 female from three different schools. More specifically 19 % of the students were in 6<sup>th</sup> and 7<sup>th</sup> grade, 21 % of the students were in 8<sup>th</sup> grade, 17 % of the students were in 9<sup>th</sup> grade, and 25 % were 10<sup>th</sup> grade students representing an age range from 11 to 18 years old ( $M = 14.21$  years,  $SD = 1.52$ ). The data was collected from four classes each from Hauptschule (86 students, 23 %) and Realschule (124 students, 38 %) from one city, as well as from 5 classes from a Gymnasium (162 students, 44%) from a neighboring city. Of all students, 91 % were involved in some kind of free time physical activity and 9 % were not. In terms of club sport participation 67 % joined organized practice, whereas 33 % did not participate in any club sports. Overall, the participation range was from 1 to 7 days a week ( $M = 3.16$ ). Participants were anywhere from 15 to 300 minutes physically active per day ( $M = 68.96$  min). The students participated in a wide variety of sports with a majority being active in soccer, team handball and weight lifting / fitness.

#### 3.2 Instruments

##### 3.2.1 Basic Psychological Needs in Physical Education

The original scale of Basic Psychological Needs (BPN) provided by Vlachopoulos & Michailidou (2006) stems from the exercise context and was adjusted to the physical education context by Vlachopoulos et al. (2011). A three-factor structure was determined

with adequate Cronbach's alpha values for internal consistency. Autonomy alphas values ranged from .80 to .84, competence alphas from .80 to .86, and relatedness alphas from .88 to .92 (Vlachopoulos et al., 2011).

The scale contains 12 items which all begin with "In general in PE..." (i.e., "Im Sportunterricht..."). In line with SDT, the BPN-PE scale contains four items for each of the subscales of Need for Autonomy ("... I feel like the activities we are doing have been chosen by me." [i.e., "...fühle ich mich, als ob ich die Übungen, die wir machen, selbst ausgesucht hätte."]), Need for Competence ("...I feel that I improve even in the tasks considered difficult by most of the children" [i.e., "...habe ich das Gefühl, jedes Mal besser zu werden, auch bei Übungen welche für die Meisten schwierig sind."]), and Need for Relatedness ("...I feel like I have a close bond with my classmates." [i.e., "...fühle ich mich meinen Mitschülerinnen / Mitschülern sehr verbunden."]), the fundamentals of the self-determination theory. The responses were given on a 7-point Likert scale stretching from 1 ("Strongly disagree" [i.e. "Ich stimme nicht zu"]) to 7 ("I agree completely" [i.e. "Ich stimme absolut zu"]).

Total scores for the three subscales are derived by calculating the mean of the respective items. More specifically, the total mean scores of all variables were calculated. Four items for autonomy needs were summarized in one Need for Autonomy score. The mean of competence needs is presented as Need for Competence. The four relatedness needs items have one composite Need for Relatedness score. In all subscales, higher values represented increased BPN support.

Additionally to the main instrument of the BPN-PE scale two additional (Perceived Autonomy in Physical Education and Subjective Vitality Scale) scales were administered to the students for cross validation. It is important to have comparable scales for reliability analysis and to investigate concurrent and content validity (Banville et al. 2000).

### 3.2.2 Perceived Autonomy in Physical Education

The original Perceived Autonomy in Physical Education Scale was also used in the original study of Vlachopoulos et al. (2011) and is adapted from the *Health Care Climate Questionnaire (HCCQ)* by Williams, Grow, Freedman, Ryan, & Deci (1996). According to Hagger et al. (2005) this scale measures how much support of autonomy the students

perceive in a certain environment. The questions were adjusted to a physical education setting by Vlachopoulos et al. (2011) and consequently the questionnaire is a short version that consisted 6 items. In the study of Vlachopoulos et al. (2011) Cronbach's alpha coefficient was satisfactory with above .90. For reasons of simplicity each item starts in the present study with "My PE teacher ..." [i.e., „Mein Sportlehrer / Meine Sportlehrerin..."]. Examples of items are "...provides me choices and options." [i.e., „...lässt mir den Freiraum selber auszusuchen, wie ich etwas auf meine eigene Art und Weise mache.“] or „...conveyed confidence in my ability to do well at athletics.“ [i.e., „...glaubt daran, dass ich es im Unterricht schaffe.“]. The items were answered on a 7-point-Likert scale from 1 ("Strongly Disagree" [i.e., "Ich stimme nicht zu"]) to 7 ("Strongly agree"[i.e., "Ich stimme absolut zu"]).

The Perceived Autonomy Support Scale with 6 items resulted in one total Perceived Autonomy Support score. Higher values represent more perceived autonomy provided by the PE teacher.

### 3.2.3 Subjective Vitality Scale

The Subjective Vitality Scale was developed by Ryan and Frederick (1997) to measure energy level of participants. Subjective Vitality is related to motivation, as well as personal well-being which should provide information about what the general vitality level is available to the self. This motivation can be caused physically, as well as psychologically (Ryan & Frederick, 1997). They provided alphas ranging from .80 to .89. Vlachopoulos et al. (2011) used a version where one item was eliminated. In the German translation all 7 items were included and a stem of "In PE classes I feel..." [i.e., "Im Sportunterricht fühle ich mich..."] was used for clarification purposes. Examples are "...little energetic." [i.e., „...kraftlos.“] or „...nearly always awake and alert.“ [i.e., „...fast immer sehr wach und bin sehr motiviert.“]. The answers were provided on a 7-point Likert scale stretching from 1 ("Not at all" [i.e., "Ich stimme nicht zu"]) to 7 ("Very true" [i.e., "Ich stimme absolut zu"]). The seven items from the Subjective Vitality scale were computed to one mean Subjective Vitality score. The total Subjective Vitality score with a higher score indicating that the students feel more energetic during PE classes.



### 3.3 Procedure

#### 3.3.1 Translation Procedure

As mentioned above, the cross-cultural translating technique introduced by researchers from North America seems to be the most appropriate in this specific case (Banville, Desrosiers, & Genet-Volet, 2000). During the progress of translating the 3 Scales of Subject Vitality, Basic Psychological Needs in Physical Education (BPN-PE), and Perceived Autonomy Support in Physical Education (PAS-PE) it is important to not translate literally word by word, but translate reasonably the meaning of each statement. The translator should keep in mind to retain the connotation of the scale. After proper translation we should be able to investigate if the newly introduced scale shows emic (culture-specific) or etic (cultural general ideas) results that are suggested in this research (Banville et al. 2000).

Banville et al. (2000) suggest a 7-step translation technique which was transformed to this cross-cultural study. First, the actual translation process was implemented by having a certified translator translating the 3 scales from Greek to German. The expert translator was informed about purpose of the study, age group, and reading skills of participants in order to reduce future problems. To reduce own culture specific tendencies this preliminary version was suggested to a committee of bilingual Greek experts in the field of physical education and further evaluated. Most of the questions received consensus and only minimal adjustments were made. The back-translation process (Banville et al. 2000; Brislin, 1986) was seen as not necessary, because the translation was made from the original Greek version and it would have caused more confusion by increasing possibility of error and inefficient work (Araya-Vargas, Gapper-Morrow, Moncada-Jimenez, & Buckworth, 2009). After receiving feedback and suggestions from the committee the scales were re-evaluated and formatted into an easily readable questionnaire form.

#### 3.3.2 Pilot Test

The preliminary experimental version was used to conduct a pilot test to evaluate content and concurrent validity. Moreover, understandability of the wording in the questionnaire

was evaluated by receiving personal feedback. The participants (N=23) from Realschule Schuettorf consisted of 9 girls and 14 boys in 5<sup>th</sup> grade. The pilot test feedback was used to format and formulate the questionnaire simpler for the age group. Also, some adjustments for the demographic section were made. All in all, the meaning and understanding for students needs to be identical in both, the Greek and the German version (Banville et al. 2000). The final version needs to be reliable, valid and objective with no questions that lead into a certain direction (see table 6).

### 3.3.3 Data Collection Procedure

For data collection three different schools were contacted which all agreed to participate in the research. Because of the school system in Germany it was necessary to contact 3 different types of schools (Hauptschule, Realschule, Gymnasium) that offer specialized education according to the perceived intellectual level of the students. After reviewing the questionnaire, each principal verified the research and assured that no permission of higher authority, such as the department of pedagogy, was needed. Furthermore, the principals took responsibility that no additional consent of parents is needed. The questionnaire was filled out by each class individually under the supervision of the current responsible teacher and the author in a classroom setting. It was reassured that the actual PE teacher was not present when the self-report questionnaire was filled out. Students were told that the participation is voluntary, strictly anonymous and that they can stop any time during the research. Furthermore, if any questions would arise they were encouraged to ask. Before handing out the questionnaire, students were informed that the questionnaire is not graded and no teacher will have admission to individual responses. The researcher also ensured so there is no need to convert with classmates. After all, the researcher emphasized to the students that only honest answers are valuable to the research, which could eventually enhance the quality of PE classes in general. Overall, the students were treated according to APA guidelines. All information collected has been kept confidential.

Furthermore, in total there were two waves of data collection. The first initial data collection ( $n = 372$ ) and a second data collection one month after the initial data collection

( $n=90$ ). The purpose for this process is the examination of consistency of the questionnaire over time, called test-retest reliability.

## 4 RESULTS

### 4.1 Missing Values Screening

Missing values need to be detected and properly handled. In this case, all missing values were detected as MCAR (missing completely at random). Furthermore, less than 5 % of the data set was considered missing which means that there is little risk of reducing the variance significantly through mean substitution. Following, the mean of each variable of the total sample was calculated and inserted for the missing value (Tabachnick & Fidell, 2007).

### 4.2 Descriptives

Total scores for all scales and subscales of the BPN-PE scale were calculated. The total score for Perceived Autonomy Support was calculated as 4.23. The mean of Subjective Vitality was determined to be 4.64. For the Basic Psychological Needs in Physical Education scale Need Autonomy scored on 4.00, Need for Relatedness on 5.11, and Need for Competence on 4.58.

Following, kurtosis and skewness levels were checked for normality. All values exhibit a normal distribution as values lie between 1.96 and -1.96. In regards of skewness all variables are skewed to the right with the highest value of -1.04 for the Needs of Relatedness. All values for kurtosis were calculated as statistically significant. Furthermore, the kurtosis for all values, with exception of the value for Needs of Relatedness, has values below 0, which means that the distribution is more flat than normally distributed. Needs for Relatedness, on the other hand, is peaked in the middle with a kurtosis value of 1.61 (see table 1).

*Table 1. Descriptive Statistics of Main Variables*

Variable (N = 372)	Mean	SD	Kurtosis	Skewness	Cronbach's alpha
Perceived Autonomy Support	4.23	1.31	-.23	-.33	.71
BPN-PE Autonomy	4.00	1.33	-.76	-.13	.83
BPN-PE Relatedness	5.11	1.11	1.61	-1.04	.80
BPN-PE Competence	4.58	1.26	-.18	-.35	.86
Subjective Vitality	4.64	1.29	-.54	-.30	.88

*Note:* BPN-PE = Basic Psychological Needs in Physical Education Scale. All variables are measured on a 7-point scale.

#### 4.3 Reliability

Internal consistency was examined with the Cronbach's alpha coefficient (see table 1). As suggested by Fraenkel and Wallen (2009) the Cronbach's alpha value should be above .7, which was the case for all variables. As it can be seen in table 1, Cronbach's alpha ranged from .71 to .88. This result is satisfactory because all values are close to or above .8, besides .71 for Perceived Autonomy Support. A Cronbach's alpha of .71 means that 71 % of variability of the composite score for the items of the subscale would be internally reliable. Furthermore, in all cases the standardized alpha is very similar to the actual Cronbach's alpha scores due to the combination of items that have comparable standard deviations.

Comparing the Alpha if Item Deleted with the original Cronbach's alpha value, only if we delete one item we can have a higher value for alpha index. The first item („...I feel that I improve even in the tasks considered difficult by most of the children“ [e.g. „...habe ich das Gefuehl, jedes Mal besser zu werden, auch bei Uebungen welche fuer die Meisten schwierig sind.“]) of the BPN-PE scale can give a higher Alpha (.88) if that Item is deleted giving a .02 difference to original alpha. Nevertheless, due to the already high value of

alpha without deleting this item, all items were considered reliable for further analysis and none of them was changed or extracted.

#### 4.4 Test-Retest

For the test-retest reliability analysis a bivariate correlation analysis was performed, which measures consistency of the scale over time. With both waves of data collections a Pearson correlation and a paired t-test can be calculated to further investigate validity of the questionnaire. All test-retest reliability coefficients are positively correlated to one another with the correlations being significant at the .01 level. Nevertheless, all correlations were measured below .07 with the lowest Pearson correlation of .40 for autonomy support (See table 2). Furthermore, the re-test the scores for all subscales were lower compared to the results of the initial test. The Paired Samples Test showed that two pairs (Competence  $p = .002$  and relatedness  $p = .000$ ) changed significantly over time. For autonomy  $p = .80$  no significance can be determined. The answers have no significant difference.

*Table 2. Test-Retest Correlation*

	1	2	3	4	5	6
1	1	.533**	.532**	.395**	.101	.262*
2		1	.441**	.471**	.544**	.369**
3			1	.527**	.446**	.516**
4				1	.719**	.675**
5					1	.590**
6						1

*Note:* \*\*  $p < .01$ , \*  $p < .05$  A= Retest. Scale. All variables are measured on a 7-point scale.

#### 4.5 Factor Analysis

In order to further investigate the factor structure between the 12 items of the BPN-PE scale an Exploratory Factor Analysis (EFA) was performed for which all items were

included. Following, factor loadings will be described in order to confirm the structure of the data. Principal Component Analysis (PCA) was chosen as best estimation method in EFA to determine the construct validity of the questionnaire and eventually reduce data to explain total variability connected to each variable included in the dataset. In this case the PCA is used to explore the interrelation between variables, and further find groups or clusters in the original dataset. Consequently, factors are detected that highly correlate, but are still independent from other subsets (Tabachnick & Fidell, 2007). Before detecting potential underlying latent exhaustion factors, the suitability of the data set for PCA needs to be determined. The dataset sample of  $n = 372$  was considered sufficient to do the Exploratory Factor Analysis. The Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) was applied to verify the sampling adequacy for PCA by looking at the factorability of the correlation matrix. The KMO characterizes the ration of squared correlation between variables to the squared partial correlation between variables, ranging from 0 to 1 (Field, 2009). Following, values close to 1 represent that the patterns of the correlation are compact, which explains that the results of the PCA are more likely to be reliable. In this case KMO with .89 is close to 1 and therefore adequate for factor analysis. Moreover, Bartlett's test of sphericity,  $\chi^2(66) = 2105.789$ , was used to determine that the correlations are near 0, which reached statistical significance ( $p < .0001$ ). Also, for several items a correlation of over  $r = .3$  was calculated. This means that correlations between items shared an adequate variance for PCA. Consequently, all 12 items are detected to use for FA.

#### 4.5.1 Factor Extraction

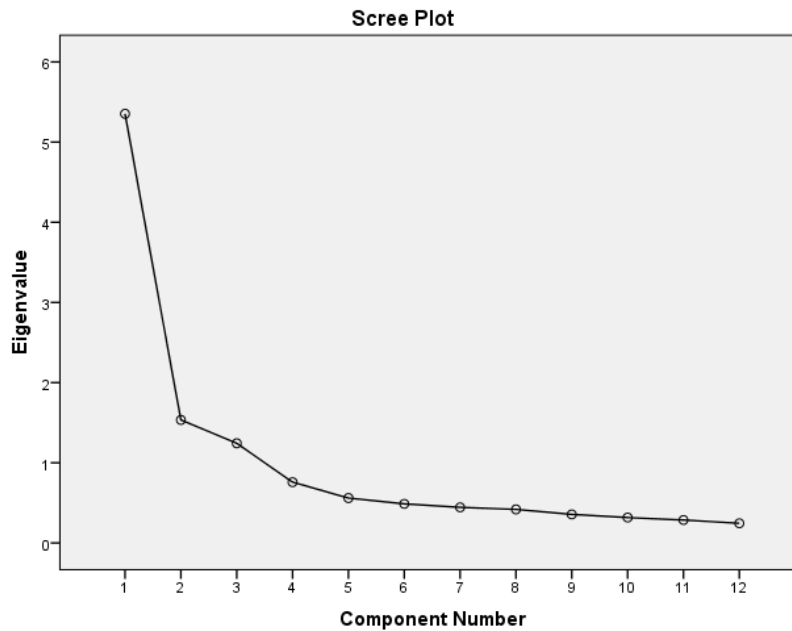
In order to perform a factor analysis, it is important to first investigate and eventually extract the smallest numbers of factors, for what different extraction techniques can be used. Furthermore, it is to determine what sets of factors should be used for better understanding and meaningful interpretation of the larger original dataset. Now, in the FA the only variance that is included is the variance that is shared between the variables. Overall, we are looking for a parsimonious account of factors for scale development (Tabachnick & Fidell, 2007). This means that it needs to be investigated how many sets of items are sufficient to capture all the information that describes the variability between the factors, which is provided from the original dataset (Tabachnick & Fidell, 2007). Principal

Axis factoring with varimax extracted three factors, whose eigenvalue was greater than 1, which stands for the amount of information that one factor contains. Consequently, PCA of the 12 remaining items determined the presence of 3 eigenvalues exceeding 1 (5.353, 1.534 and 1.243). The first initial eigenvalue explained 44.61 % of the variance of the 12 items, the second factor 12.79 %, and the third factor 10.36 % of the variance, which sums to a communality of 67.755 cumulative percent of the initial eigenvalues. Items 4 to 12 had eigenvalues below 1. The correlations coefficient showed moderate correlation between the extracted factors. Correlation coefficient between factor 1 (competence) and factor 2 (autonomy) is .574. Factor 2 is correlated to factor 3 (relatedness) by  $r = .697$ . Factor 1 and factor 3 share a correlation of .492.

Moreover, considering the scree plot of each eigenvalue in the Catell's scree test (see figure 3) it can be seen that three eigenvalues are above 1.0 and could be used as components. It can be seen that the vertical oriented items have a clear drop with a sudden transition to the items that are horizontally oriented and have values below 1. The 4<sup>th</sup> item would only represent a variance of 6.32 percent, with which we can concludes that only three sets of items will be used for EFA, because they are more information-laden.



Figure 3. Scree Plot of Catell for Factor Extraction



As a result, after establishing three sets of items for EFA, first, the Component Matrix is taken into consideration. EFA determines how many actual latent variables underlie one set of items and defines the meaning of factors. Furthermore, this could lead to decreasing variables that measure the same outcomes or eliminating items that cannot be categorized. It can be seen that all items load on the first set of items (above .5.11). The loadings for component two and three are much weaker. Because our goal is to get four items in each of the set of items columns, this solution is not sufficient.

After all, three sets of items are retained for factor rotation, which is performed to categorize loadings together. Consequently, we facilitate the progress to investigate what items correlate the best with one another. This increased interpretability is obtained by calculating a Rotated Component Matrix, an orthogonal rotation method, called Varimax with Kaiser Normalization(see table 4).. An orthogonal method was chosen because the variables are originally independent from one another. Moreover, Varimax rotation decreases the factors that have high loadings for each subscale and maximizes the sum of variance. As a result, we hope to find sets of factors that have the same loading as the

subscales being determined previously. Following, we can identify sets of items that can be characterized by one latent variable (Tabachnick & Fidell, 2007).

Overall, Factor loadings should be .7 or higher. But because a loading .7 or higher is available for nine of the factors, the set of factors counts as explained. Furthermore, all primary loadings were the highest for the predetermined desired components (see table 4). Moreover, because the 3-component structure of the original scale stays, the same internal consistency is maintained through the results of FA and all items have high inter-item correlation (see 4.3 Reliability)

*Table 4. Factor Structure of Factor Analysis.*

*Pattern and Structure Matrix for PAF with Promax Rotation of Three Factor Solution of BPN-PE Items*

Item	Pattern Coefficients			Communalities h <sup>2</sup>
	Factor 1	Factor 2	Factor 3	
Autonomy 1		<b>.642</b>		.612
Autonomy 2		<b>.815</b>		.699
Autonomy 3		<b>.825</b>		.737
Autonomy 4		<b>.774</b>		.631
Competence 1	<b>.585</b>			.469
Competence 2	<b>.860</b>			.796
Competence 3	<b>.833</b>			.794
Competence 4	<b>.843</b>			.762
Relatedness 1			<b>.855</b>	.749
Relatedness 2			<b>.786</b>	.679
Relatedness 3			<b>.446</b>	.493
Relatedness 4	.420		<b>.778</b>	.709

*Note:* major loadings for each item are in bold. All values >.4 presented.

#### 4.6 Construct Validity

All of the German BPN-PE subscales had significant moderate correlation with both comparison scales of perceived autonomy support and subjective vitality. Consequently, the construct validity of the BPN-PE is supported (see table 5).

*Table 5. Pearson's Correlations between Variables*

Variables	1	2	3	4	5
1. Perceived Autonomy Support	1	.43**	.33**	.61**	.43**
2. BPN-PE Competence		1	.53**	.53**	.58**
3. BPN-PE Relatedness			1	.44**	.42**
4. BPN-PE Autonomy				1	.61**
5. Subjective Vitality					1

*Note:* \*\*  $p < .01$ . BPN-PE = Basic Psychological Needs in Physical Education Scale. All variables are measured on a 7-point scale.

## 5 DISCUSSION AND CONCLUSION

Overall, it was explained that physical education is a good possibility to promote lifelong physical activity, when basic psychological needs of students are met by the educator. The SDT helps to understand and integrate need satisfaction of students. In order to investigate the effectiveness of physical activity interventions in PE, it is important to have a tool that measures motivation of students.

The aim of this study was to translate and assess the validity and reliability of the Basic Psychological Needs in Physical Education Scale. Validating the scale allows to investigate the student's competence, autonomy, and relatedness in context of motivation in school. By investigating the psychological need satisfaction links can be found between the structure of the lessons and the students' activity, as well as pleasure during PE classes. With evaluating students' motivation in PE classes, it is further easier to intervene the issue of physical inactivity and support long-term out-of-school physical activity. Those basic psychological needs, no matter where you are from or in what culture you grow up, needs to be satisfied in order to fulfill your life with satisfaction (Vlachopoulos, 2012).

Regarding the descriptive statistics moderately high levels of Basic Psychological Needs Satisfaction were reported by the German students. Relatedness was valued the highest by the students, following by competence and autonomy which scored lower. The same pattern for the descriptive statistics was present in the study conducted by Vlachopoulos et al. (2011) and Koka and Hagger (2010).

Furthermore, looking at the internal consistency reliability the results from this study are comparable to earlier findings by Vlachopoulos (2012) who calculated a Cronbach's alpha coefficient of .83 for competence, .76 for relatedness, and .71 for autonomy. In the present study the same pattern was detected with alpha for competence of .86, alpha for relatedness of .83, and alpha for autonomy of .80. Based on these results, the present study is etic to the Greek study (Banville et al. 2000). Consequently, all values lie over the usual cut-off point and are acceptable in terms of reliability and internal consistency (Fraenkel & Wallen, 2009).

The exploratory factor analysis resulted in satisfactory results for the three-factor structure of the original BPN-PE scale suggested by Vlachopoulos et al. (2011). All three factors have 4 clear item loadings each to the intended factor.

The test-retest reliability showed that there exist moderate interclass correlations coefficients (ICC) in the range of .40 for competence to .54 for relatedness. Although this is not an adequate ICC test-retest score, further investigation showed that there is little change between the mean scores of the initial data collection and the second wave data collection of the retest. Consequently, the test-retest can be considered reliable.

Finally, construct validity can be confirmed with positive moderate correlations between PAS, SV and the subscales of BPN-PE with correlations ranging from .33 between PAS and BPN-PE relatedness to .61 between SV and BPN-PE and relatedness (see table 2).

After all, in a school setting, physical activity can be beneficial for academic achievement even if it takes time off the subject curriculum. Intellectual skills are learned though sports and taking time off physical education would not increase the grades of students.

Moreover, physical education would be more beneficial if more emphasis was placed on the educational aspect instead of competitiveness. With autonomous motivation in physical education self-esteem can be predicted, which is further an important indication for well-being (Standage & Gillison, 2007). Furthermore, self-efficacy and attributional feedback from the teacher are main predictors for motivation in students, which is formed through interaction with the environment (Zhang & Lu, 2002). Regarding the teacher, according to Ntoumanis and Standage (2009) the behavior and interpersonal interaction of the teacher towards the students strongly influences the motivational climate and it further influences the general attitude towards physical activity. In this context, an intervention was implemented by Tessier, Sarrazin, and Ntoumanis (2010) which resulted in a change of the interpersonal style of the teacher. This intervention was successful and it resulted in better class management regarding the motivational climate. Following results and conclusion will be discussed, as well as limitations and implications for future research will be presented.

### 5.1 Limitations and Future Direction

The German school system requires mandatory physical education classes throughout the whole academic school career. This involves motivational issues like in any other class, since the subject is not selected voluntarily. During the years of high school, which are represented in the present study, there is little room for individually preferred disciplines and the curriculum is planned by the educational ministry of the state. Consequently, all students need to cover the same curriculum. More specifically, there is limited leeway for the teacher to involve students in decision-making processes, although the teacher might be aware of an autonomous supportive climate.

All participants were drawn from a rural area in the northwest of Germany. Consequently, the results could represent students of public schools of rural areas in the age range from 12 to 16, which is representative for the distribution of students generally. However no conclusions can be drawn to the general population of Germany. To further validate the scale, the scale ought to be tested with other samples for different ages and school systems, as well as urban areas. In context of limitations, the temporal stability can also be discussed. The basic psychological needs satisfaction is a quite instable or quickly changing phenomenon that is difficult to measure in forms of questionnaires. Finally, although students were educated to answer honestly, social pressure and biased answers cannot be avoided completely.

Nevertheless, it was explained that physical education is a good possibility to promote lifelong physical activity when basic psychological needs of students are met by the educator. The SDT helps to understand and integrate need satisfaction of students. In order to investigate the effectiveness of physical activity interventions in PE, it is important to have a tool that measures motivation of students. Furthermore, with this specific data collection, gender and cultural differences can be observed and further investigated, from which we could draw more conclusions regarding students' motivation in PE classes. Comparing the results of this study with other countries would increase the knowledge on what basic psychological needs of students the teacher needs to focus on in order to increase motivation. Also, female and male have slightly different needs, which ought to

be approached differently. With this scale motivational processes can be further investigated and the teaching style can be adapted.

## 5.2 Conclusion

The present study presents the factorial validity, internal consistency, and test-retest stability of the BPN-PE scale in Germany. As an initial result, validity and reliability for three concrete factors could be determined from answers of a sample of high school students. These factors were all highly internally consistent, and test-retest reliability was sufficient. The original structure of the questionnaire is validated to be used as a measurement tool in German school systems. The German BPN-PE scale constitutes a valid measurement tool to further investigate and potentially increase students' motivation in PE classes – and thus potentially increase their physical activity for life.

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## APPENDICES

*Table 6: German Experimental Version of the BPN-PE Scale***Einwilligung zur Teilnahme an dieser Umfrage****No. ...**

Liebe Schülerinnen und Schüler,

die Teilnahme ist freiwillig und du musst deinen Namen nicht aufschreiben. Die Umfrage ist anonym. Eure Antworten werden nur den Forschern, KEINEM LEHRER ODER SCHULDIREKTOR, zur Verfügung gestellt. Die Umfrage wird nicht benotet, sondern dient dazu, den Sportunterricht besser zu gestalten. Ein ehrliches Ausfüllen des Fragebogens ist ganz wichtig.

Das Thema der Umfrage ist – Wie erlebe ich den Sportunterricht?

Wenn du an der Umfrage teilnimmst, fülle bitte alles aus.

Wir bedanken uns,

Philip Heckmann

University of Jyväskylä,

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Finnland



1. Geschlecht: Junge  Mädchen
2. Geburtsdatum: \_\_\_\_\_
3. Klasse: \_\_\_\_\_
4. Schulform: \_\_\_\_\_
5. Größe: \_\_\_\_\_ cm
6. Gewicht: \_\_\_\_\_ kg
7. Muttersprache: \_\_\_\_\_ / \_\_\_\_\_
8. Machst du in deiner Freizeit Sport? Ja  Nein
9. Sport in einem Verein / feste Gruppe? Ja  Nein
10. Wenn ja, welche Sportart(en)? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
11. Wie oft in der Woche? \_\_\_\_\_ mal pro Woche
12. Für wie lange? \_\_\_\_\_ Minuten pro Einheit

**Wie stark stimmst Du den Aussagen zu? Bitte kreise immer nur eine Zahl pro Aussage ein.**

Mein Sportlehrer / meine Sportlehrerin ...		Ich stimme nicht zu		Keine Meinung			Ich stimme absolut zu	
		1	2	3	4	5	6	7
<b>1</b>	...lässt mir den Freiraum, selber auszusuchen, wie ich etwas auf meine eigene Art und Weise mache.	1	2	3	4	5	6	7
<b>2</b>	...versteht mich.	1	2	3	4	5	6	7
<b>3</b>	...glaubt an mich und daran, dass ich es im Unterricht schaffe.	1	2	3	4	5	6	7
<b>4</b>	...regt mich an, Fragen zu stellen.	1	2	3	4	5	6	7
<b>5</b>	...nimmt meine Wünsche bezüglich des Inhalts des Unterrichts zur Kenntnis.	1	2	3	4	5	6	7

6	...fragt, ob ich alles verstehe.	1	2	3	4	5	6	7
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<b>Im Sportunterricht...</b>		Ich stimme nicht zu			Keine Meinung		Ich stimme absolut zu	
1	...habe ich das Gefühl, jedes Mal besser zu werden, auch bei Übungen welche für die meisten schwierig sind.	1	2	3	4	5	6	7
2	...besteht ein freundschaftliches Verhältnis zwischen mir und meinen Mitschülerinnen/Mitschülern.	1	2	3	4	5	6	7
3	...machen wir Sachen, die mich interessieren	1	2	3	4	5	6	7
4	...habe ich das Gefühl, dass ich sogar Übungen, welche für die meisten schwierig sind, richtig mache.	1	2	3	4	5	6	7
5	...fühle ich mich meinen Mitschülerinnen/ Mitschülern sehr verbunden.	1	2	3	4	5	6	7
6	...habe ich nichts an der Art und Weise wie der Unterricht stattfindet, auszusetzen.	1	2	3	4	5	6	7
7	...habe ich das Gefühl dass ich sogar Übungen, welche für die meisten schwierig sind, sehr gut bewältige.	1	2	3	4	5	6	7
8	...habe ich das Gefühl, dass ich ein wichtiges Mitglied der Gruppe bin.	1	2	3	4	5	6	7
9	...finde ich die Art und Weise, wie der Unterricht stattfindet sehr ansprechend.	1	2	3	4	5	6	7
10	...bewältige ich mit Leichtigkeit sogar Übungen, welche für die meisten schwierig sind.	1	2	3	4	5	6	7
11	...habe ich das Gefühl, zur Gruppe dazu zu gehören	1	2	3	4	5	6	7
12	...fühle ich mich, als ob ich die Übungen, die wir machen, selbst ausgesucht hätte.	1	2	3	4	5	6	7

<b>Im Sportunterricht fühle ich mich...</b>		Ich stimme nicht zu			Keine Meinung		Ich stimme absolut zu	
1	...sehr lebendig.	1	2	3	4	5	6	7
2	...mich kraftlos.	1	2	3	4	5	6	7
3	...manchmal so munter, ich möchte vor Freude springen.	1	2	3	4	5	6	7

<b>4</b>	...voller Energie.	1	2	3	4	5	6	7
<b>5</b>	...als könnte ich es jedes Mal kaum erwarten, bis der Sportunterricht anfängt.	1	2	3	4	5	6	7
<b>6</b>	...fast immer sehr wach und bin sehr motiviert.	1	2	3	4	5	6	7
<b>7</b>	...als werde ich angeregt, Dinge zu tun.	1	2	3	4	5	6	7